

The May number of the *Journal of the Chemical Society* opens with an important paper by Mr. W. H. Perkin on "Artificial Alizarin." He first gives a sketch of the notions entertained by chemists as to the composition and relations of this important colouring matter prior to the investigations of Messrs. Graebe and Liebermann. These chemists showed that by treating alizarin obtained from madder with powdered zinc, a hydrocarbon was produced of the composition $C_{14}H_{10}$ and possessing all the properties of the anthracene of coal tar. By oxidising anthracene it is converted into anthraquinone $C_{14}H_8O_2$; by the action of bromine dibromanthraquinone $C_{14}H_6Br_2O_2$ is produced, and by subsequent treatment with potassic hydrate at a high temperature, an alkaline solution of alizarin $C_{14}H_8O_4$ is obtained—being the first instance of the artificial formation of a natural colouring matter. Mr. Perkin, in England, and Messrs. Caro, Graebe, and Liebermann, in Germany, have succeeded in obtaining the alizarin without the use of bromine. This may be effected by treating the anthraquinone with strong sulphuric acid, when disulphanthraquinonic acid $C_{14}H_6O_2(HSO_3)_2$ is formed, and this, when digested with potassic hydrate at 180° , gives rise to potassic sulphate and the potash compound of alizarin. The alizarin prepared from anthracene is identical with that extracted from madder. It has the same appearance, behaves in the same manner with reagents, produces the same effects in the dye bath, and exhibits the same absorption bands when examined spectroscopically. Two patterns dyed with artificial alizarin accompany the paper.—The second paper is by Mr. John Hunter, and contains some "Analyses of Deep Sea Water, and of some Ooze from the bottom of the Atlantic," collected during the expedition of H.M.S. *Porcupine*.—We then have a paper by Dr. Gladstone, on the "Refraction Equivalents of Aromatic Hydrocarbons and their Derivatives," being a continuation of the subject of the lecture reported in the previous number. Messrs. T. Bolas and C. E. Groves have experimented on the preparation of bromopicrin. They give exact directions for the preparation of this substance by acting on picric acid with bromide of lime, a compound analogous to bleaching powder. Bromopicrin has a very high specific gravity, 2.811 at $12.5^\circ C$. The authors announce that they have obtained the carbonic bromide CBr_4 by acting on bromopicrin with powerful brominating agents.—The concluding paper is by Prof. How, on an "Acidified Water from the Coal-field of Stellarton, Nova Scotia." This water was found to be distinctly acid, in consequence of its containing a considerable quantity of free sulphuric acid, probably produced from the iron pyrites present in the coal strata.

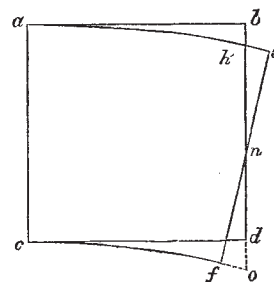
SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 19.—"On the Cause and Theoretic Value of the Resistance of Flexure in Beams." By W. H. Barlow, F.R.S.

The author refers to his previous papers, read in 1855 and 1857, wherein he described experiments showing the existence of an element of strength in beams, which varied with the degree of flexure, and acts, in addition to the resistance of tension and compression of the longitudinal fibres. It was pointed out that the ratio of the actual strength of solid rectangular beams to the strength, as computed by the theory of Leibnitz is, in cast iron, as about $2\frac{1}{2}$ to 1; in wrought iron as $1\frac{3}{5}$ and $1\frac{1}{2}$ to 1; and in steel, as $1\frac{1}{3}$ and $1\frac{1}{4}$ to 1. The theory of Leibnitz assumes a beam to be composed of longitudinal fibres only, contiguous, but unconnected, and exercising no mutual lateral action. But it is remarked that a beam so constituted would possess no power to resist transverse stress, and would only have the properties of a rope. Cast iron and steel contain no actual fibre, and wrought iron (although some qualities are fibrous) is able to resist strain nearly equally in any direction. The idea of fibre is convenient as facilitating investigation; but the word fibre, as applied to a homogeneous elastic solid, must not be understood as meaning filaments of the material. In effect it represents lines of direction, in which the action of forces can be ascertained and measured, for in torsion-shearing and "angular deformation" the fibres are treated by former writers as being at the angle of 45° , because it has been shown that the diagonal resistances have their greatest manifestation at that angle. Elastic solids being admitted to possess powers of resistance in the direction of the diagonals, attention is called to omission of the effect of resistance in the theory of beams. The author then states, as the result of his in-

vestigation, that compression and extension of the diagonal fibres constitute an element of strength equal to that of the longitudinal fibres, and that flexure is the consequence of the relative extensions and compressions in the direct and diagonal fibres, arising out of the amount, position, and direction of applied forces. Pursuing the subject, it is shown that certain normal relations subsist between the strains of direct fibres and their relative diagonals, evenly distributed strain being that in which the strain in the direct fibres is accompanied by half the amount of strain in the relative diagonal fibres. Any disturbance of this relation indicates the presence of another force. Thus tensile forces applied at right angles to compressive forces of equal amount, produce no strain in the diagonals. But if forces applied at right angles to each other are both tensile, or both compressive, the strain in the diagonal is as great as that in the direct fibres. It is also pointed out that in a given fibre a, b, c , the point may be moved with regard to a and c , thus producing plus and minus strains in the same fibre. Treating a solid as being made up of a series of laminae, and showing that every change of figure can be represented by the variation in length of the diagonals, taken in connection with those of the direct fibres, the author proceeds to trace the effects of the application of tensile and compressive forces acting longitudinally on either side of the neutral plane, and shows that curvature is the result of the relation between the strains in direct fibres and those in the diagonals. The operation of a single tensile force applied along one side of the plate and a transverse stress are likewise traced out, and the conditions of "elastic equilibrium" referred to. The amount of resistance offered by the diagonal fibres is shown as follows:—



a, b, c, d represents a portion of a beam strained by transverse forces into the circular curve a, e . Two resistances arise. 1. That due to the extension and compression of the longitudinal fibres produced by the rotation of b, d about the neutral axis, which is the resistance considered in the theory of Leibnitz. 2. That due to the extension and compression of the diagonal fibres, caused by the deformation of the square a, b, c, d into the figure a, h, o, c , which is the resistance of flexure. It is then shown that in a solid rectangular beam, the second resistance is equal to the first, and that both resistances act independently, and consequently that the true theoretic resistance of a solid rectangular beam is exactly twice that arrived at by the theory of Leibnitz. The strength so computed is in general accordance with the results of experiments in cast iron, wrought iron, steel, and other materials, the maximum strength being found in cast iron, which is one-eighth above, and the minimum in glass, which is one-fourth below the calculated strength. The author considers this treatment of the subject as arising necessarily out of Dr. Hook's law "ut tensio sic vis," and that it is in effect completing the application of those principles which are only partially applied by Leibnitz. The paper concludes with some practical illustrations (accompanied by photographs) of the effect of diagonal action. The appendix contains the results of experiments on the tensile, compressive, and transverse resistances of steel.

"On some Elementary Principles in Animal Mechanics.—No. IV. On the difference between a Hand and a Foot, as shown by their Flexor Tendons." By the Rev. Samuel Haughton, M.D. Dublin, D.C.L. Oxon, Fellow of Trinity College, Dublin.

The fore feet of vertebrate animals are often used merely as organs of locomotion, like the hind feet; and in the higher mammals they are more or less "cephalised," or appropriated as hands to the use of the brain. The proper use of a hand when thus specialised in its action, is to grasp objects; while the proper use of a foot is to propel the animal forward by the intervention of the ground. In the case of the hand, the flexor

muscles of the fore arm act upon the finger tendons, in a direction from the muscles towards the tendons, which latter undergo friction at the wrist and other joints of the hand, the force being applied by the muscles to the tendon above the wrist, and the resistance being applied at the extremities of the tendons below the wrist by the object grasped by the hand. From the principle of "Least Action in Nature" we are entitled to assume the strength of each portion of a tendon to be proportional to the force it is required to transmit; and since, in a proper hand, these forces are continually diminished by friction, as we proceed from the muscle to the fingers, we should expect the strength of the tendon above the wrist to be greater than the united strengths of all the finger-tendons. Conversely, in a proper foot, the force is applied by the ground to the extremities of the tendons of the toes, and transmitted to the flexor muscles of the leg, by means of the tendons of the inner ankle, which undergo friction in passing round that and the other joints of the foot. In this case, therefore, we should expect the united strengths of the flexor tendons of the toes to exceed the strength of the flexor tendons above the heel. In the case of the hand, friction acts against the muscles; in the case of the foot, friction aids the muscles. I have measured the relative strengths of the deep flexor tendons of the hand above and below the wrist in several animals, and also the relative strengths of the long flexor tendons of the foot above and below the ankle, in the following manner:—I weighed certain lengths of the tendons above the wrist and ankle, and compared these weights with the weights of equal lengths of the flexor tendons of the fingers or toes, assuming that the weights of equal lengths are proportional to their cross sections, and these again proportional to the strengths of the tendons at the place of section. The difference between the weights above and below the joint represents the sum of all the frictions experienced by the tendons between the two points of section. Tables are given showing the results of measurements, *e.g.*, in the case of the Pyrenean Mastiff the amount of friction is 65.4 per cent., while in the Boomer Kangaroo it is *nil*. The foregoing animals all realise the typical idea of a true foot, with a variable amount of friction at the ankle-joint; this friction disappearing altogether in the Boomer Kangaroo, whose method of progression realises absolute mechanical perfection, as no force whatever is consumed by the friction of the flexor tendons at the heel. The only animals whose feet deviated from the typical foot were three, *viz.*, the Alligator, common Porcupine, and Phalanger. In these animals the foot has the mechanical action of a hand, or grasping organ; and the flexor tendons above the ankle exceeded those below the ankle by the following amounts:—Alligator, 11.5 per cent.; common Porcupine, 20.0; Phalanger, 29.2. In the case of the flexor tendons of the hand results were obtained varying from 71.0 in the case of the Common Porcupine, to *nil* in the case of the Goat. It will be observed that the fore foot of the goat, regarded simply as an organ of locomotion, attains a perfection comparable with that of the hind foot of the kangaroo, no force being lost by friction at the wrist-joint. The only animal in which I found a departure from the typical hand was the Llama, in which the flexor tendons of the fingers exceed the flexor tendon above the wrist by 14.4 per cent. The bearing of the foregoing results on the habits of locomotion of the several animals will suggest themselves at once to naturalists who have carefully studied those habits. I shall merely add that the subject admits of being carried into the details of the separate or combined actions of the several fingers and toes, and that the habits of various kinds of monkeys in the use of certain combinations of fingers or toes may be explained satisfactorily by the minute study of the arrangement and several strengths of the various flexor tendons distributed to the fingers or toes.

PARIS

Academy of Sciences, May 23.—M. Jordan communicated a theorem on doubly periodical functions.—A note by M. L. Cailletet on the compressibility of gas at high pressures, was communicated by M. H. Sainte-Claire Deville.—M. Chapelas presented a note on the aurora borealis of the 20th May, which was observed to move from west to east, and was followed by great atmospheric disturbances coming from the south-west.—M. E. Lagout described a cheap equatorial sundial which he has invented for the purpose of regulating time-pieces. It costs from 8 to 12 francs.—M. A. Trecul presented a note on the hailstones which fell at Paris during the storm of the 22nd May. These were pear-shaped, and very large, some

measuring more than three-quarters of an inch in length. One of them showed at its larger end the form of an obtuse-angled rhombus.—A note on the clouds, fogs, and rains with sand, observed in Italy in 1869, by M. Zantedeschi, was read.—Several chemical papers were communicated, namely:—A memoir on the action of water upon iron, and of hydrogen upon oxide of iron, by M. H. Sainte-Claire Deville. A report by M. Chevreul on a memoir by M. Vétillard on the vegetable fibres employed in manufactures, describing the distinctive characters of the principal textile materials as evinced by microscopic observation and by treatment with iodine and sulphuric acid. A note by M. Schützenberger on the compounds of protochloride of platinum with oxide of carbon; one by M. M. Prudhomme on the action of acetylene upon acetohypochlorous anhydride (acetate of chlorine); and one by the same author, on the action of sulphuric anhydride upon protochloride and sesquichloride of carbon, all communicated by M. H. Sainte-Claire Deville.—Observations on the constitution of the flame of the fish-tail gas-burner, by M. A. Baudrimont. The author found that the obscure part of the flame possesses heat sufficient to fuse a platinum wire.—A note by M. A. Vezian, on the system of mineral veins of the Hunsrück, was read; and an extract from a letter by M. de Botella, noticing two recent cases of elevation of land in Spain. Upon the latter M. Elie de Beaumont made some remarks.—M. Cl. Bernard presented a contribution to the knowledge of the minute structure of the mammary gland, by MM. G. Giannuzzi and E. Falaschi. M. d'Abbadie suggested the desirableness of a decimal division of the circle and of time; and General Morin presented a note on some earthenware stoves, manufactured by Müller and Co., of Ivry, which, as he stated, utilise no less than 93 per cent. of the heat developed by the coke consumed in them. Several other papers and communications were read of which the titles only are given.

May 30.—A paper by M. E. Combesence on some differential formulæ was presented by M. Hermite; and a note on a formula of analysis, by M. F. Lucas, was communicated by M. Liouville. General Morin communicated a memoir by MM. C. Martins and G. Chancel on the physical phenomena which accompany the rupture of hollow projectiles of various calibres by the congelation of water contained in them. The numbers obtained by the authors are about one half those obtained by General Morin from the formulæ given by him in his lectures on practical mechanics. General Morin, M. Dumas, and M. Elie de Beaumont made some remarks upon this communication.—M. Jamin presented a note by MM. A. Cornu and E. Mercadier, on melodic and harmonic intervals, in reply to a paper by M. Guérout, read on May 9.—M. Jamin also communicated two notes by M. Tréve on electric currents. In one of these the author cited some further observations in support of his assertion that two currents cannot circulate in opposite directions in the same wire or in the same Geissler's tube; in the second he indicated a method of explaining the course of the currents in telegraphy when terrestrial communications are employed without a return wire. He maintained that the soil is to be regarded as a common reservoir rather than as a conductor.—A note by M. J. Mario on the phenomena of electrostatic induction was read. From his experiments he proposed a theory of terrestrial currents, according to which the sun would be a source of positive electricity acting by induction upon the earth.—A note by M. Neyreneuf, on the theory of electrical condensers, was also read.—The following papers on chemical subjects were read:—A note by M. Cloëz, claiming priority in the discovery of the cyanic and cyanuric ethers, presented by M. Cahours.—A note by MM. Gal and Gay-Lussac, also presented by M. Cahours, on some compounds homologous with tartaric and malic acids. These compounds were adipomalic, adipotartaric, suberomalic, and suberotartaric acids; they are obtained by the action of bromine upon adipic and suberic acids.—A note on the action of hydrochloric acid upon osseine, including researches upon determination of the quantity of osseine in fossil bones, by M. Scheurer Kestner, communicated by M. Balard. The author stated that the solubility of a portion of the osseine in bones is independent of the action of hydrochloric acid, which may be reduced to almost nothing by sufficient dilution. He replied to some remarks of M. Elie de Beaumont on his former paper on this subject.—A note, by M. Sacc, on the preparation of pyrotartaric acid. The process proposed by the author consists in dissolving anhydrous tartaric acid in commercial acetic acid, and heating the mixture in a retort until it becomes

syrupous; in a day or two the vessel is filled with acicular crystals.—A memoir was read on the organisation of silicified branches probably belonging to a *Sphenophyllum*, by M. B. Renault. The author described the structure of a stem, which he identifies with *Sphenophyllum* (naming the species *S. Charmassii*), and from the characters displayed by which he is led to remove *Sphenophyllum* from the Equisetaceæ.—M. Blanchard presented a memoir by M. Lacaze Duthiers containing his researches upon the evolution of *Molgula tubulosa*. The author stated that the larva of this species, instead of the tadpole-like form supposed to be common to the larvæ of the Ascidia, is an amoeboid body which, as it were, flows out of the ruptured egg.—M. A. Duméril presented a note, by M. G. Pouchet, on some monstrous gold fish (*Cyprinus auratus*) from China. This note related to the well-known doubling of the tail in these fish, which, according to the author, always occurs below the extremity of the vertebral column.—M. de Quatrefages presented a note, by M. Bordone, on the organisms which are developed in the silkworms attacked by the disease called *Morts flats*. M. Dumas made some remarks upon this paper.—M. Decaisne communicated a note, by M. J. E. Planchon, on the Phthiriosis of the vine known to the ancients, and on the Coccidæ of the vine of modern times. The cause of the vine-disease known to the Greeks as Phthiriosis is said by M. Korossios to be the *Phylloxera*; the author stated that it was a coccid, but not, as supposed by Walckenaer, the *Coccus Vitis*. (Linn.) He identified it with *Dactylopius longispinus*, of Targioni Tozzetti.—M. A. Duméril presented a note by M. E. Moreau, on the cranial region of *Amphioxus*, forming a continuation of his paper on the structure of the dorsal chord in that fish.—A note by M. N. Gréhan, on the rapidity of the absorption of oxide of carbon by the lungs, was communicated by M. Cl. Bernard. The author stated that the absorption of oxide of carbon into the blood commences immediately, and advances rapidly. The blood of a dog breathing air containing one-tenth of oxide of carbon, furnished a gaseous mixture containing 4.28 per cent. of oxide of carbon, in less than 25 seconds, and 18.41 per cent. in less than 1½ minute.—M. C. Robin presented a note by M. J. Chéron, on the state of muscular contractibility, judged comparatively by means of continuous currents, and of currents of induction, in a certain number of paralysed.—M. C. Sainte-Claire Deville presented the first volume of the "Bulletin of the Meteorological Observatory of Montsouris," and made some remarks upon its contents.—Numerous other papers and memoirs were communicated, of which we have only the titles.

BERLIN

German Chemical Society, May 23.—M. Ador has obtained the radical of phthalic acid by treating its chloride with silver. Three molecules thus unite into one. The new body yields three different acids by oxidation, the last of which is phthalic acid.—A. Baeyer, in his own and in M. Emmerling's name, reported on the transformation of isatine into indigo. As isatine, when treated with nascent hydrogen, unites with it and forms indol, a substance not capable of uniting with the reduced substance was sought for, and discovered in phosphorus, the solvent employed being chloride of acetyl or of phosphorus. Real indigo-blue and indigo-red were thus produced. The latter stands in the same relation to the blue as purpurine does to alizarine. To complete the long hoped-for discovery of producing artificial indigo, all that remains to be done is now to transform indol into isatine.—Prof. Cannizzaro, of Palermo, sent in a paper on isomeric cyanuric ethers. Solid chloride of cyanogen acting on benzylic alcohol produces an ether isomeric with one formerly described, and belonging to the series lately investigated by Hofmann.—Messrs. Gomp-Besanez and Grinva have produced artificially the essential oil of rue by distilling together caprate of sodium $C_{10}H_{19}NaO_2$, and acetate of sodium. The acetic nature and the formula $C_{11}H_{22}O$ (hitherto doubtful) of the oil are thereby fully established.—C. Rammelsberg, in a paper on meteorites, remarked on the absence of alkalis in these celestial rocks. The "Shalkah" stone found in India has lately been analysed, and consists of 22 per cent. of olivine and 88 per cent. of bronzit. He found that sulphuric acid only attacks the former mineral and leaves the latter untouched.—Messrs. Naumann and Vogt report on what Wurtz considered as a combination of chloride of cyanogen with hydrocyanic acid, but which according to them is a mixture.—A. Claus has studied the action of bromine on dichlorhydrine, and that of chloride of sulphur on aniline. The latter reaction has not as yet produced pure substances.—L.

Henry by treating with nitric acid, glycol, lactic, and malic acids, has replaced the alcoholic group OH by the group NO_2 .—A. W. Hofmann reported on the danger of preparing chloride of cyanogen by the action of chlorine on cyanide of mercury. Sometimes explosions take place during this preparation, particularly at the end of it, when the salt remaining behind and acted upon is a double salt of the chloride and the cyanide of mercury.—Messrs. Baeyer and Martins recommended the action of chlorine on hydrocyanic acid, and that of chloride of lime on cyanide of potassium for producing chloride of cyanogen.

DIARY

THURSDAY, JUNE 9.

ZOOLOGICAL SOCIETY, at 8.30.
MATHEMATICAL SOCIETY, at 8.
ROYAL INSTITUTION, at 3.—Electricity: Prof. Tyndall.

FRIDAY, JUNE 10.

ROYAL INSTITUTION, at 8.—The Ammonia Compounds of Platinum: Prof. Odling.
ROYAL ASTRONOMICAL SOCIETY, at 8.
QUEKETT MICROSCOPICAL SOCIETY, at 8.

SATURDAY, JUNE 11.

ROYAL INSTITUTION, at 3.—Comets: Prof. Grant.

MONDAY, JUNE 13.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.

TUESDAY, JUNE 14.

ANTHROPOLOGICAL SOCIETY, at 8.—On the Kelts of Ireland: Dr. John Beddoe.—On the Irish Celts: Dr. H. Hudson.—Notes on the Race Elements of the Irish People: G. H. Kinahan.
PHOTOGRAPHIC SOCIETY, at 8.

WEDNESDAY, JUNE 15.

METEOROLOGICAL SOCIETY, at 7.—Anniversary Meeting.

THURSDAY, JUNE 16.

ROYAL INSTITUTION, at 8.30.
ROYAL SOCIETY OF ANTIQUARIES, at 8.30.
LINNEAN SOCIETY, at 8.
CHEMICAL SOCIETY, at 8.
NUMISMATIC SOCIETY, at 7.—Anniversary Meeting.

BOOKS RECEIVED

ENGLISH.—Atlas and Handbook of Physical Geography: Keith Johnston, jun. (Johnston and Co.).—The Story of Aristæus and his Bees: R. M. Millington (Longmans).—Selections for Latin Prose: R. M. Millington (Longmans).
FOREIGN.—Leçons d'Optique physique: E. Verdet. Masson, Paris.—(Through Williams and Norgate).—Traité de Paléontologie Végétale, et Atlas. Tom ii. pt. 1^{re}: W. P. Schimper.—Beiträge zur Morphologie und Physiologie der Pilze: A. de Bary and Woronin.

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ERRATA.—In No 31, p. 95, second column, line 52 from top, for "fires" read "fuses;" lines 58 and 61 (*dis*), for "carbonate" read "carbamate."